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The Contents.

New Experiments, to the number of 16, *concerning the Relation between* Light *and* Air (*in* Shining Wood *and* Fiſh); *ſhewing, That the withdrawing of the Air from thoſe and the like Bodies, extinguiſhes their Light, and the readmiſſion of the Air reſtores it. An Account of two Books:* I. PARTHOLOGIÆ CEREBRI & NERVOSI GENERIS SPECIMEN: *In quo agitur de* MORBIS CONVULSIVIS & SCORBUTO, *ſtudio* THOMÆ WILLIS M.D. II. ALPHABETUM NATURÆ. *Authore* F. M. B. V. HELMONT.

New Experiments

Concerning the Relation between Light *and* Air (*in Shining Wood and Fiſh*); *made by the Honourable* ROBERT BOYLE, *and by him addreſſed from* Oxford *to the* Publiſher, *and ſo communicated to the* Royal Society.

SIR,

TO perform now the promiſe I made you the other day, I muſt acquaint you with what will perhaps ſomewhat ſurpriſe you, by giving you an Account of what I tried on Tueſday night laſt (Octob. 29: 1667.) *and the two or three following nights, about the Relation between* Air *and* Light, *as this is to be found in ſome Bodies.*

The occaſion of theſe Trials was this: Having, as you know, long ſince made ſome Notes, chiefly Hiſtorical, upon particular Qualities, *and finding* Light *to be (how juſtly, I now diſpute not) reckon'd by the generality of Philoſophers among* Qualities, *I handled together what Obſervations I had either made by my ſelf, or received from ſome ingenious Travellers (to whom I recommended my Enquiries) about* Shining *Bodies; and had alſo prepared ſeveral Trials about them, to be made when I ſhould have opportunity, and requiſite Inſtruments to put them in*

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practice, which, as to ſome of thoſe deſigned Experiments, have been long denied me. But having at length got hither one of my little Engines, *and having alſo procured, after much enquiry, a few ſmall pieces of* Shining Wood, *I began on the day abovementioned to try with them an Experiment I found in my Liſt. And though the main Experiment be but one, I intended to ſet down what occurr'd to me about it but as ſeveral* Phænomena *of it; yet finding it requiſite to acquaint you with ſome Tryals that are not ſo properly Parts of it, I ſhall for diſtinction ſake propoſe them as ſeveral Experiments; the* Narratives *whereof are taken, for the moſt part,* verbatim *out of the Notes I ſet down for my own uſe, when the things to be regiſtred were freſhly done. Which Advertiſement I give you, both to excuſe the careleſneſs of the Style, and to induce you not to diſtruſt a Narrative that was made only to ſerve my Memory, not an* Hypotheſis.

Experiment I.

TO try whether or no a piece of *Shining Wood*, being put into a *Receiver* of our *Pneumatick Engine*, would, upon the withdrawing and readmitting of the *Air*, ſuffer ſuch changes, as I have often obſerved a *Live Coal*, placed there, to do; having at length procured a piece of ſuch Wood, about the bigneſs of a *Groat* or leſs, that gave a vivid Light (for *rotten Wood*), we put it into a middle-ſized *Receiver*, ſo as it was kept from touching the Cement; and the Pump being ſet a work, we obſerved not, during the *five* or *ſix* firſt Exſuctions of the Air, that the ſplendour of the included *Wood* was manifeſtly leſſened (though it never was at all increaſed); but about the *ſeventh* ſuck, it ſeemed to grow a little more dim, and afterwards anſwered our expectation, by loſing of its Light more and more, as the Air was ſtill further pumped out; till at length about the *tenth* Exſuction (though by the removal of the Candles out of the Room, and by black Cloaths and Hats we made the place as dark as we could, yet) we could not perceive any Light at all to proceed from the Wood.

Experiment II.

WHerefore we let in the outward Air by degrees, and had the pleaſure to ſee the ſeemingly extinguiſht Light revive ſo faſt and perfectly, that it looked to us all almoſt like a little flaſh of Lightning, and the ſplendour of the Wood ſeemed rather greater, than at all leſs, than before it was put into the *Receiver.* But partly for greater certainty, and partly to enjoy ſo delightful a ſpectacle, we repeated the Experiment with the like ſucceſs as at firſt. Wherefore being deſirous to ſee how ſoon theſe Changes might be produced, we included the Wood in a very ſmall Receiver of clear Glaſs, and found, That in this the Light would begin to grow faint at the *ſecond,* or at leaſt at the *third* Exſuction of the Air, and at the *ſixth* or *ſeventh* would quite diſappear. And we found by a Minute-Watch, that the ſending the Candles out of the Room, the pumping out the Air 'till the Wood would ſhine no more, the readmitting of the Air (upon which it would in a trice recover its Light) and the ſending in for the Candles to conſult the Watch, did in all take up but *ſix* Minutes.

Experiment III.

THe forementioned Experiment, without taking notice how long it laſted, being reiterated twice in this new Receiver, we had a deſire to ſee, whether this *luminouſneſs* of our Wood would more reſemble a *Coal,* or the Life of a *perfect Animal,* in being totally and finally extinguiſht, in caſe the Air were kept from it a few minutes, or elſe the Life of *Inſects,* which in our exhauſted *Receiver* I had obſerved to loſe all appearance of its continuing, and that for a much longer time than a few minutes, and yet afterwards, upon the reſtitution of Air, to recover preſently, and ſhew manifeſt ſigns of Life: Wherefore having exhauſted the *Receiver,* 'till the Wood quite diſappeared, we ſtayed ſomewhat above a quarter of an hour in the dark, without perceiving that the Wood had regained any thing of Light, though about the end of this time we made the place about it as dark as we could; and then it being too late at night to protract the Experiment, we let in the Air, upon whoſe admiſſion the Wood preſently recovered Light enough to be conſpicuous at a diſtance, though it ſeemed to me ſomewhat leſs vivid than before; which yet may be either a weakneſs in my ſight, or an effect of the ſteams of the Cement, unfriendly perhaps to the Luminouſneſs of the Wood.

Thus far we proceeded yeſter-night, to which we this Night added theſe Obſervations.

We put in a piece of Wood bigger than the former (this being above an inch long) and that ſhone very vigorouſly. And having by a few ſucks quite deprived it of Light, we left it in the exhauſted *Receiver* for full half an hour, and then coming into the dark Room again, we found all had not continued ſo ſtanch, but that ſome ſmall portion of Air had inſinuated it ſelf into the *Receiver.* This we concluded to be but a ſmall portion of Air, becauſe the Wood was but viſible to an attentive Eye. And yet, that it was really ſome Air, which was got in, that cauſed the little glimmering light, which we perceived, may appear by this, that it did preſently (as we expected) vaniſh at the firſt or ſecond ſuck; and then the Air being let into the dark *Receiver*, the included Wood preſently ſhone again as before, though I ſuſpected, I diſcerned ſome little diminution of its brightneſs; which yet, 'till further Trials of the like kind, and for a longer time, have been made, I dare not affirm. Before the *Receiver* was ſufficiently emptied at the beginning of the Experiment made with this greater piece of Wood, a ſmall Leak accidentally ſprung, which, letting in a little Air, did ſooner than we intended, recall the almoſt diſappearing Light.

Experiment IV.

THere is an Experiment of affinity with the former, which we thought it not altogether impertinent to try: For having obſerved on another occaſion, That ſometimes the Operation, which the withdrawing the Air hath upon a Body included in the *Receiver,* proves more conſiderable ſome *minutes* after we have ceaſed pumping, than *immediately* after the exerciſe is left off, I imagined, that even in ſuch caſes, where the Light is not made wholly to diſappear (though it be made almoſt quite to do ſo) by the emptying of the *Pneumatical* Glaſs, the ſuffering the Body to remain a while there, though without any pumping (unleſs now and then a very little to remove the Air, that might have ſtollen in in the mean time) the remaining Light of the Body might probably be further impaired, if not reduced quite to vaniſh. To examine this conjecture, we put in a Body that was not Wood, which had ſome parts much more luminous than the reſt; and having drawn out the Air, all the others diſappeared, and even the formerly brighter ones ſhone but faintly, when the *Pneumatical Glaſs* ſeemed to be exhauſted. But keeping the included Body a while in that unfriendly place, we perceived the parts, that had retained light, to grow more and more dim, ſome of them diſappearing, and that, which was formerly the moſt conſpicuous, being now but juſt viſible to an attentive Eye, and that ſcarce without diſpute; for if we had not known beforehand, that a ſhining matter had been included in the *Receiver*, perhaps we ſhould not have found it out. And he that had the youngeſt Eyes in the company could not at all diſcern it, (the Air being let in, the Body began to ſhine again.) But this being a ſingle Trial, which the lateneſs of the night hinder'd us from reiterating, is to be further proſecuted, and in differing ſubſtances, before much be built upon it.

Experiment V.

THe *Rarefaction* or Expanſion of the Air having ſo notable an operation upon our ſhining Wood, I thought it would not be amiſs to try, what the *Compreſſion* of the Air would do to it. For which purpoſe we included a piece of it in ſuch a little Inſtrument to compreſs, which you may remember to have been deviſed and propoſed by Mr. *Hook*. But though we impell'd the Air forcibly enough into the Glaſs, yet by reaſon of the thickneſs requiſite in ſuch Glaſſes, and the opacity thence ariſing, we were not able then to determine, whether or no any change was made in the luminouſneſs of the Wood.

Which I thought the leſs ſtrange, becauſe by ſome Experiments purpoſely deviſed (at one of which I remember you were preſent) I had long ſince obſerved, That even a great preſſure from a fluid Body, which preſſeth more uniformly againſt all the parts, it toucheth of the conſiſtent Body, does work a far leſs manifeſt change even on ſoft or tender ſubſtances, than one would expect from the force wherewith it compreſſeth.

And were it not, that one contrary oftentimes minds us of another, I might have forgot, that I had divers thoughts about finding ſome good ways of Trying, whether any ſuch change of Texture might be diſcover'd to be made in the ſhining Wood by the abſence and return of the ambient Air, as might with any probability have the loſs or recovery of the Woods ſplendour attributed to it. For I had formerly (if I were not miſtaken) found by ſeveral circumſtances, which I ſhall not now ſtay to name, That a ſlight (ſo it be an appropriated) variation of the Texture of this Wood, and which may ſeem mainly to reſpect the Pores (which perhaps ought to be of a determinate ſhape and ſize, and filled with a determinate matter) will have a great operation upon its ſplendour. And I formerly found by other Trials, that even conſiſtent Bodies, if ſoft ones, may have their Pores enlarged and vitiated, and their bulk, and conſequently their texture (at leaſt as to their Pores) manifeſtly enough alter'd, by having the Air withdrawn from about them (whereby the Aerial Particles within them were enabled to expand themſelves) and let in again, whereby, as to ſenſe, they ſeemed pretty well reſtored to their former ſtate. But the ſucceſs of my endeavours either with *Microſcopes* (through which a vivid piece of Wood will ſhine by its own light) or otherwiſe, was not conſiderable enough to deſerve a particular account, eſpecially in this Paper, where I am not to venture at matter of *Theory*.

Experiment VI.

THinking fit to try, Whether a ſmall quantity of Air, without being venilated or renewed, might not ſuffice to maintain this cold Fire, though it will not that of a Live Coal, or a piece of Match, we cauſed a piece of ſhining Wood to be Hermetically ſealed up in a pipe of clear and thin Glaſs; but though carrying it into the dark, we found it had quite loſt its light, yet imagining that that might proceed from its having been overheated (being ſealed up in a Pipe not long enough to afford it a due diſtance from the flame of the Lamp we employ'd to ſeal it) we cauſed two or three pieces of freſh Wood, amounting all of them to the length of about two inches, to be ſeal'd up in a ſlender pipe between four or five inches in length; which being warily done, the Wood retained its light very well, when the Operation was over; and afterwards laying it by my bed-ſide, when the Candles were carried away out of the Room, I conſidered it a while before I went to ſleep, and found it to ſhine vividly.

The next morning when I awaked, though the Sun was riſen, yet forbearing to draw open the Curtains of my Bed 'till I had looked upon the ſealed Glaſs, which I had fenced with a piece of Cloth held between it and the Window, my Eyes having not yet been expoſed to the day-light ſince the darkneſs they had been accuſtomed to during the night, made me think the Wood ſhined brighter than ever. And this night, after ten of the Clock, looking on it in a dark place, it appeared luminous all its length, though not ſo much ſo as in the morning.

The morning after, and the night after that, the ſame Wood did likewiſe manifeſtly, though not vigorouſly ſhine, eſpecially one piece, whoſe light was much more vivid than the reſt. And, for ought I know, I might have obſerved them to ſhine longer, if one of the ſealed ends of the Glaſs had not been accidentally broken.

Experiment VII.

WHilſt the former Trials were making, I was wiſhing for a good *Bolonian* Stone, to try what effect the withdrawing of the Air would have upon it. For though I knew it might be objected, that the Experiments of Light performable in our *Engine*, muſt be made in the night, whereas the *Bolonian* Stone gains its light by being expoſed to the Sun-beams, yet that Objection did not hinder my wiſh, ſince the better ſort of *Bolonian* Stones may be indued with a luminouſneſs by the flame of Fire, or of large Candles.

I alſo wiſhed for ſuch a *ſhining Diamond*, as is now in the hands that beſt deſerve ſuch a Rarity, our *Royal Founder*'s. For you may remember, that in the Obſervations I made of that Stone, and annexed to the concluſion of the Book of *Colours*, I ſhew how it may ſeveral ways be brought to ſhine; ſo that by one or other of thoſe ways, eſpecially that of external Heat, I thought it very likely I ſhould be able to make the light continue four or five minutes, which would be long enough to try in a very ſmall *Receiver*, exhauſtible at a Suck or two, whether the withdrawing and reſtoring the Air would have any viſible Operation on it:

I alſo wiſht for ſome of the *Glow-worms*, with which I formerly made other Trials. For though I forgot not what operation the withdrawing of the Air by our *Engine* is wont to have upon living Creatures; yet that made me not forbear my wiſh, not only becauſe of the different effect I have found the *Engine* to have on *Inſects* in reſpect of other Animals, but becauſe I am not of the opinion of thoſe modern Writers, who will have the Light of *Glow-worms* depend altogether upon their Life, and end with it. But being not likely by my wiſhes to procure any new ſubject to make trials on, I thought fit at leaſt to do what was in my power, and accordingly (to gratifie them, who, I preſumed, would, if preſent, propoſe ſuch a Trial) cauſed a piece of *Iron* to be forged, whoſe top was of the bigneſs of a *Nutmeg*; the reſt being a ſtem, of an inch, or an inch and a half long, for which we provided a little Candleſtick of Tobaccopipe-clay, which would not yield any ſmoak to fill and darken the *Receiver*. Then having heated the *Iron* red-hot, and placed it in this Clay, ſo that the round part was clearly *protuberant*, we convey'd it into the *Receiver* of white Glaſs, which was ſo placed, as to keep the ſides at as good a diſtance as we could from the *Iron*, leſt the exceſſive heat ſhould (as we much feared it would) break the Glaſs. Then ſending away the Candles, and making the Room dark, we haſtily pumped out the Air, but could not perceive the withdrawing of it had any operation on the glowing *Iron*. And though it continued ſhining long enough to give us opportunity to pump out and let in the Air three ſeveral times, yet we could not obſerve, that the Air had any manifeſt operation one way or other. For though upon the withdrawing of the Air the *Iron* grew dimmer and dimmer, yet that I attributed to the *cooling* of it; and the rather, becauſe having (to examine the conjecture) let in two or three times the Air, when the *Receiver* had been exhauſted, there appeared no manifeſt increaſe of Light upon ſudden admiſſion of it.

Experiment VIII.

Having formerly in our *Phyſico-Mechanical* Experiments, about the *Spring* of the *Air*, obſerved, That the Air is thus far a Vehicle of *Sound*, that a Body but faintly ſounding, being placed in our *Receiver*, gave a yet weaker ſound when the Air was withdrawn from about it, than when the *Receiver* was full of Air: I preſumed, ſome curious perſons would, if they had been preſent, deſire to have a trial made, whether or no a ſmall piece of *Shining Wood* being ſo included in the *Receiver*, as that the pumping out of the Air ſhould have no injurious operation upon the body of it, its Light would upon the withdrawing of the Air be manifeſtly diminiſh'd. And this I was the leſs backward to try, becauſe (not to mention the *Relation*, which the former Experiments ſhew there may be in ſome caſes between *Light* and *Air*) it did not readily occur to my memory, that by any *manifeſt Experiment* (for I know, there are probable Reaſons to prove it) it appeared, that a Body more thin than Air will or can tranſmit Light, as well as other *diaphanous mediums*. And thoſe modern *Atomiſts*, that think, there is in our *exhauſted Receiver* very many times more *Vacuum* than *Body*, would, I preſumed, be glad to be ſupplied with an Argument againſt the *Peripateticks*, to ſhew, That the motion of Bodies, *viz.* the Corpuſcles of Light, may be freely made in *Vacuo*, and proceed without the aſſiſtance of a Vehicle.

Wherefore having *Hermetically* ſealed up a ſmall piece of *Shining Wood* in a ſlender Pipe, and placed it in a ſmall *Receiver* that was likewiſe made of clear Glaſs, we exhauſted it of Air, and afterwards let in again that which we had excluded. But by neither of the Operations could we perceive any ſenſible decrement or encreaſe of the Light of the Wood, though by that very Obſervation it appeared, that the Glaſs had been well ſealed, ſince otherwiſe the included Air would have got out of the Pipe into the *Receiver*, and have left the Wood without Light.

Experiment IX.

I Had alſo a mind to try, both what *degree* of *Rarefaction* of the *Air* would deprive the *Wood* of its ſplendour in ſuch and ſuch meaſures, and whether or no the ſelf-ſame Air, which, when rarified, would not ſuffer the Wood to ſhine, would, when reduced to its former denſity, allow it to ſhine as much as before.

This I propoſed to do, by putting ſome *Shining Wood* into a clear and conveniently ſhaped Glaſs, that the long Stem or Pipe being ſo far filled with *Quickſilver*, as that there might be about half a ſpoonful of Air left at the encloſed end where the *Wood* was placed, it might be inverted into a little Glaſs of *Stagnant Quickſilver*, and therewith conveyed into a ſlender *Receiver*, out of which, as the *Air* ſhould come to be pumped, *that* included in the Glaſs, which held the Wood, might be rarified, and afterwards upon the admiſſion of the outward *Air* (which muſt impell up the *Quickſilver* to its former height) might be reſtored to its former ſtate: But when we came to make trial of this, we had no *Receiver* conveniently ſhaped that was ſo clear and thin, as that we could ſee the *Wood* ſhine through both the Glaſſes. And though we would for an Expedient have ſubſtituted a fine thin Bladder wherein the Wood was to be put, and a convenient quantity of *Air* ſtrongly tied up with it, yet for want of a Bladder fine enough for our turn, that Expedient alſo proved uſeleſs to us. But being deſirous to make what trial we could by the leaſt unfit means we had in our power, we got an old, but thin Glaſs, ſealed at one end, whoſe ſhape was pretty *Cylindrical*, and whoſe *bore* was about the bigneſs of a man's little finger, and whoſe length was about a foot or more. Into this Pipe, near the ſeal'd end, we put a piece of *Shining Wood*, wedged in with a piece of Cork to keep it from falling; and having inverted the noſe of it into another ſlender Glaſs, but not *Cylindrical*, wherein was pretty ſtore of *Quickſilver*, we put them both into a long *Receiver*, ſhaped almoſt like a *Glaſs Churn*, and having pumped a while, that the Air included in the Pipe expanding it ſelf, might depreſs the *Quickſilver*, and ſo make eſcapes into the *Receiver* as long as we thought fit; we then let in the outward Air, that the *ſtagnant Quickſilver* might be impelled into the cavity of the Pipe now freed from much of the Air, to the height requiſite for our purpoſe.

This done, we plied the Pump again, and obſerved, That as the Air in the Pipe did by its own *Spring* expand it ſelf more and more, and grow thinner and thinner, the *Shining Wood* grew dimmer and dimmer, till at length it ceaſed to ſhine, the internal *Air* being then got a good way lower, than the ſurface of the external *Quickſilver*; whereupon opening the commerce between the cavity of the *Receiver*, and the *Atmoſphere*, the Quickſilver was driven up again,and conſequently,the *Air* above it was reſtored to its former denſity; upon which, the *rotten Wood* alſo recover'd its light. What the greateſt Expanſion of this *Air* was, we could not certainly determine, becauſe the Expanſion raiſed the *external* Quickſilver ſo high, as to hinder us to ſee and meaſure it. But we gueſſed, that the Air reached to about a foot or more from the top of the Pipe to the ſurface of the Quickſilver near the bottom of it. But when that rarified Air was impell'd into its former dimenſions, we meaſured it, and found, that the upper part of the Tube, unpoſſeſt by the Quickſilver, was about three inches; and the Wood being about an inch long, there remained two inches or ſomewhat better for the Air. But this Experiment is to be repeated, when exacter Inſtruments can be procured.

Experiment X.

THinking it fit to try, as well, Whether *ſtinking Fiſh* that ſhines be of the ſame nature,as to Luminouſneſs,with *rotten Wood* that ſhines too; as, whether the withdrawing of the Air will extinguiſh or eclipſe the Light of a conſiderable *bulk* of luminous matter, as in the Experiments hitherto made,we found it would do to a *ſmall* one: We took a Fiſh that we had kept, and cauſed to be watched 'till 'twas almoſt all over Luminous, though much more in the Belly,and ſome parts of the Head,than elſewhere: And having ſuſpended him in a conveniently ſhaped *Receiver,* we found him to give ſo great a light, that we ſuſpected beforehand, that the withdrawing of the Air would hardly have its full operation upon a Body, whoſe *bulk* was conſiderable, as well as its *light* very vivid, and which had many luminous parts retired to a pretty diſtance from the Air. Accordingly having exhauſted the *Receiver* as much as we were wont, it appeared indeed, eſpecially towards the latter end of the operation, that the abſence of the Air did conſiderably *leſſen*, and in ſome places *eclipſe* the light of thoſe parts that ſhone leſs ſtrongly. But the *Belly* appeared not much leſs luminous than before: Wherefore ſuppoſing, that upon the turning of the *Stop-cock,*the Air coming in much more haſtily than it could be drawn out,we ſhould have the beſt advantage to diſcern, what intereſt it had in the Luminouſneſs of the Fiſh, we readmitted it, and upon its ruſhing in, perceived the Light to be as it were revived and encreaſed; thoſe parts of the Fiſh that were ſcarce viſible before, or ſhone but dimly, receiving preſently their former ſplendour.

And not to leave unproſecuted the remaining part of the Experiment, which was to try, Whether it was the *Kind* of the Luminous Body, or only the *greatneſs* of the *Bulk*, and the *vividneſs* of *Light*, and, if I may ſo ſpeak, the *Tenacity* of the ſubſtance it reſided in, that made the difference between the *Fiſh* and the *Wood*; we put part of the Fiſh of another kind, that ſhone much more faintly than *that* hitherto ſpoken of, and but in ſome places; and by the withdrawing the *Air*, we made ſome of the luminous parts diſappear, and the others ſo dim, as ſcarce to be diſcerned, and yet both the one and the other regained their former light upon the return of the Air.

And to purſue the Experiment a little further, we put in ſuch a piece of the firſt Fiſh as though it were bright, was yet but thin, and not conſiderably great, and upon pumping out the *Air*, we found it, according to our expectation, quite eclipſed, though it recovered its Light upon the Air's re-entry.

THeſe, Sir, *are the Experiments I have lately made about* Shining Bodies *in our* Engine. *More I would have tried, notwithſtanding the trouble we found in managing the Engine in the dark, if* rotten Wood *had not failed us, and if I were not in a place, where Glaſs-men's Shops are not near ſo well furniſh'd as the Stationers.*

I ſcarce doubt, but theſe Experiments will occaſion among the Virtuoſi *ſeveral* Queries *and* Conjectures, *according to the differing* Hypotheſes *and Inquiſitions, to which men are inclined. And particularly 'tis probable, that ſome will make uſe of this Diſcourſe to countenance their Opinion, That notwithſtanding the* Coldneſs *(at leaſt as to ſenſe) of Fiſhes and other Animals, there may be in the* Heart *and* Blood *a* Vital *kind of* Fire, *which needs Air, as well as thoſe Fires that are ſenſibly hot: Which may leſſen the wonder, that Animals ſhould not be able to live when robbed of Air. And if I had now time, I could poſſibly furniſh you with ſome other Trials, that ſeem much to favour the Compariſon, though as to the opinion it ſelf of a* Vital Flame, *I ſhall not now tell you my thoughts about it. And though not only the* Carteſians *will perhaps draw an Argument from the paſt* Phænomena *in favour of their* Theory *of* Light, *but divers others will diſcourſe upon them, and propoſe further Queſtions, and perhaps Enquiries ſuitable to their ſeveral* Hypotheſes; *yet I ſhall content my ſelf at preſent to have faithfully delivered the* Hiſtorical *part of theſe* Apparences, *without* *making, at leaſt at this time, any Reflections on them. And the rather indeed, becauſe I enjoyed ſo little health when I was making the Experiments, that 'twas not fit for me to engage in* Speculations, *that would much exerciſe my thoughts, which, I doubt, have been more gratified, than my health hath been by the bare Trials, which are moſt ſeaſonably made at hours unſeaſonable for one that is* not *well.*

POSTSCRIPT

Sent by the ſame Noble Author *from the ſame place,* December 6. 1667.

M*Y condition in point of health being not much improved ſince I writ to you in* October *laſt, when I ſhall have added, that I have not theſe five or ſix weeks been able to procure any* Shining Wood *(except one ſingle piece, which, though large, was ſo ill condition'd, that it afforded me but one Trial) you will not, I hope, expect, that I ſhould add much to the Experiments I formerly ſent you, about the Relation 'twixt* Light *and* Air. *But however, ſince the Subject is new and noble, and ſince your curioſity about other matters has been ſo welcome and uſeful to the* Virtuoſi, *I ſhall not decline even on this occaſion to comply with it, and the rather, becauſe I half promiſed you ſome* Additionals *a good while ſince, and becauſe too, that though, what I ſhall acquaint you with, may ſeem to be but a Confirmation of two or three of the former Experiments; yet, beſides that 'tis of them which moſt needed a Confirmation, theſe Trials will alſo afford ſome Circumſtances that will not, I think, be unwelcom.*

Experiment XI.

TO examine then the Conjecture mentioned in the laſt Experiment, That the durableneſs of the Light in the *Shining Fiſh,* in ſpight of the withdrawing the Air, might proceed in great part from the vividneſs of it, and the beauty of the matter it reſided in, rather than from the Extent of the Luminous Body, in compariſon of the ſmall pieces of *Shining Wood,* I hitherto had made my Trials with; I put in the above-mentioned piece of Wood, whoſe luminous Superficies might be perhaps ten or twelve times as great as that which the Eye ſaw at once of the ſurface of ſuch fragments of *Shining Wood*; as I was wont to employ: And though ſome parts of this large *Superficies* ſhined vividly (for the light was uſually enough for rotten Wood, inferiour to that of our Fiſh) yet this great piece being put into a convenient *Receiver*, was, upon the withdrawing of the Air, deprived of Light, as the ſmaller ones had been formerly; the returning Air reſtoring its Light to the one, as it had done to the other.

Experiment XII.

BUT this is not the chief thing I intended to acquaint you with, *That* being the ſucceſs of ſome Trials, which we made in proſecution of theſe two neighbouring Experiments.

In the *firſt* of theſe I told you, I had been able to try but for half an hour or a little more, that a *ſhining* piece of *Wood*, deprived in our *Engine* of Light, would yet retain a diſpoſition to be as it were rekindled upon the freſh acceſs of the Air. Wherefore, though I could have wiſhed to have made a further Trial with the ſame kind of Bodies, yet being able to procure none, I ſubſtituted in their room ſmall pieces of *rotten Fiſh*, that ſhone ſome of them more faintly, and ſome of them more vividly, in reference to one another, but none as ſtrongly as ſome that I could have employed; and having in a very ſmall and clear *Receiver* ſo far drawn off the Air, as to make the included Body diſappear, we ſo ordered the matter, that we kept out the Air for about 24 hours; and then allowing the Air to re-enter in a dark place, and late at night, upon its firſt admittance the *Fiſh* regain'd its Light.

Experiment XIII.

THis, compar'd with ſome of my former Obſervations about *Putrefaction*, put me upon a Trial, which, though it miſcarried, I ſhall here make mention of, that in caſe you, who are better furniſh'd with Glaſſes, think it worth while, you may get reiterated by the *Society*'s Operator; conſidering then, how great an intereſt *Putrefaction* hath in the *ſhining* of *Fiſhes*, and *Air* in the *Phænomena* of *Putrefaction*, I thought it might be ſomewhat to the purpoſe, to take a Fiſh that was, according to the common courſe I had obſerved in Animals, not far from the ſtate, at which it would begin to ſhine; and having cut out a piece of it, I cauſed the reſt to be hung up again in a Cellar, and the exſected piece to be put into a ſmall and tranſparent *Receiver*, that we might obſerve, if a day or two, or more, after the Fiſh in the Celler ſhould begin to ſhine, that in the exhauſted *Receiver* would either alſo ſhine, or (becauſe that ſeemed not likely) would, notwithſtanding the check, which the abſence of the Air might be preſumed to give the *Putrefaction*, be found to ſhine too, either immediately upon the admiſſion of the Air, or not long after it.

But this Experiment, as I lately intimated, was *only* deſign'd and attempted, not compleated; the *Receiver* being ſo thin, that upon the exhauſtion of the *internal* Air, the *weight* of the *external* broke it; and we could ill ſpare another of that kind from Trials, we were more concerned to make: Notwithſtanding which, we made one Trial more, which ſucceeded no better than the *former*, but miſcarried upon a quite differing account, *viz.* becauſe neither the included piece of Fiſh, nor the remaining, though it were of the ſame ſort with the Fiſhes I uſually employed, would ſhine at all, though kept a pretty while beyond the uſual time, at which ſuch Fiſhes were wont to grow luminous.

If this Experiment had ſucceeded, I had ſome others to try in proſecution of it, which I ſhall not now trouble you with the mention of. But that this *Paragraff* may not be uſeleſs to you, I'le take this occaſion to give you a couple of *Advertiſements*, that may relate not only to this Experiment, but alſo more generally to thoſe, whether precedent or ſubſequent, where *ſhining Fiſh* are employed.

Advertiſement I.

In the firſt *place then, I will not undertake, that all the Experiments you ſhall make with* rotten *Fiſh, ſhall have juſt the ſame ſucceſs with theſe I have related. For, as I elſewhere obſerved, (in a* Diſcourſe *written purpoſely on that Subject) that the event of divers other Experiments is not always certain, ſo I have had occaſion to obſerve the like about* Shining *of* Fiſhes. *And, beſides what I lately took notice of at the cloſe of the tenth Experiment, I remember, that having once*

once deſigned to make Obſervations about the Light *of* rotten Fiſhes, *and having in order thereunto cauſed a competent number of them to be bought, not one of them all would ſhine, though they were bought by the ſame perſon I was wont to employ, and hung up in the ſame place where I uſe to have them put, and kept not only 'till they began to putrifie, but beyond the time that others uſed to continue to ſhine; although a parcel of the ſame kind of Fiſhes, bought the week before, and another of the ſame kind, bought not many days after, ſhined according to expectation. What the reaſon of this diſappointment was, I could not determine; only I remember, that at the time, it happen'd, the weather was variable, and not without ſome days of Froſt and Snow. Nor is this the oddeſt Obſervation I could relate to you about the* uncertain ſhining *of* Fiſhes, *if I thought it neceſſary to add it in this place.*

Advertiſement II.

Notice muſt alſo be taken in making Experiments with ſhining Fiſh, *that their luminouſneſs is not wont to continue very many days. Which Advertiſement may be therefore uſeful, becauſe without it we may be apt ſometimes to make Trials, that cannot be ſoon enough brought to an iſſue; and ſo we may miſtake the loſs of Light in the Fiſh to be a deprivation of it cauſed by the Experiment, which indeed is but a ceſſation according to the uſual courſe of Nature.*

Experiment XIV.

I Know not whether you will think it worth while to be told of a Trial that we made, to ſave thoſe *Criticks* a labour, that elſe might perhaps demand, why 'twas not made. We put therefore a piece of *Shining Fiſh* into a wide-mouth'd Glaſs, about half filled with fair Water, and having placed this Glaſs in a *Receiver*, we exhauſted the Air for a good while, to obſerve, Whether, when the preſſure of the Air was removed, and yet (by reaſon of the Water that did before keep the Air from immediately touching the Fiſh) the Exhauſtion of the *Receiver* did not deprive the Fiſh of that contact of Air, which it had loſt before: Whether, I ſay, in this caſe the abſence of the Air would have the ſame influence on the ſhining Body, as in the former Experiments? And here, as far as the numerous bubbles excited in the Water would give us leave to diſcern it (for they did, though not unexpectedly ſomewhat diſturb the Experiment, which inconvenience we might have prevented, if we had thought it worth while) we could not perceive, that either the abſence or return of the Air had any great operation upon the Light of the immerſed Body; which yet did not keep me from intending to make a ſomewhat-like Trial with *Shining Wood* (when I can get any) faſtened to the lower part of a clear Glaſs, and covered over, but not very deep, with *Quickſilver.* Of which practice I ſhall not now ſtay to give you the Reaſons, having elſewhere fully enough expreſſed them.

And that this *Section* may acquaint you with ſomething beſides the (ſeemingly) inſignificant Experiment related in it, I ſhall here inform you (ſince I perceive, I did not in the firſt Papers I ſent you) that though, when I formerly put together ſome Notes about Luminous Bodies, I confined not my Obſervations to one or two ſorts of Fiſhes, yet the Experiments, ſent you ſince *October* laſt, were all of them (except a *Collateral* one or two) made with *Whitings*, which, among the Fiſhes, I have had occaſion to take notice of, is (except one ſort that I cannot procure) the fitteſt for ſuch Trials, and conſequently fit to be named to you, to facilitate your future ones, in caſe you think it requiſite to make any upon ſuch ſubjects.

Experiment XV.

THe other of the two neighbouring Experiments I lately mention'd (*viz.* the ninth) I told you, when I ſent it you, needed a reiteration to confirm it, ſince we had but once tried it (and that without all the conveniency we deſired) that a ſhining Body, which upon the firſt withdrawing the Air loſeth *much*, but not *all* its Light, may be deprived of the reſt by continuing in that unfriendly place, though the Air be no further exhauſted. To proſecute therefore both the Experiments in one Trial, we took ſomewhat late at night a piece of rotten Fiſh, which we judged to ſhine too ſtrongly, to be quickly deprived of all its Light, and having put it into a ſmall and clear *Receiver*, we found (as we had foreſeen) that the Light was much impaired, but nothing near

ſup-

ſuppreſſed by the withdrawing of the Air. Wherefore having removed the *Receiver* into a convenient place, I cauſed it to be brought to me about midnight (after I was in Bed) and having by cloſe drawing the Curtains, and other means, made the place pretty dark, I perceived the included Body to continue to ſhine more vividly than one would have expected, (and, if I miſtake not, I ſaw it ſhining in the morning, whilſt it was dark;) but the night after, coming to look upon it again, its light appeared no more: notwithſtanding which, I made a ſhift to keep out the Air about 24 hours longer, and ſo after 48 hours in all, we opened the *Receiver* in a dark place, and preſently upon the ingreſs of the Air were pleaſingly ſaluted with ſo vivid an Apparition of Light, that the included Body continued to ſhine, when carried into a Room, where there was both Fire and Candle, if it were but by a Hat ſcreen'd from the beams.

Being encouraged, as well as pleaſed with this ſucceſs, we forthwith exhauſted the Air once more out of the ſame *Receiver*, and having kept it about 4 hours longer, we lookt upon it again in a dark place, and finding no appearance of Light, let the Air in upon it, whereby it was made to ſhine again, and that vigorouſly enough, ſo that I had cauſed the *Receiver* to be exhauſted once more, but that it being *Sunday* night, I was unwilling to ſcandalize any, by putting my Servants upon a laborious, and not neceſſary work.

The ſuddenneſs, with which the included Body appeared to be, as 'twere, rekindled upon the firſt contact of the Air, revived in me ſome ſuſpicions I have had about the poſſible cauſes of theſe *ſhort-liv'd Apparitions* of Light (for I ſpeak not now of *real* Lamps found in Tombs, for a reaſon to be told you another time) which diſcloſing themſelves upon mens coming in, and conſequently letting in freſh Air into Vaults, that had been very long cloſe, did ſoon after vaniſh. Theſe thoughts, as I was ſaying, occurr'd to me upon what I had been relating, by reaſon of the ſudden operation of the freſh Air upon a Body, that but a minute before diſcloſed no light. For though the Lights reported to have been ſeen in Caves, quickly diſappeared, which that of our Fiſh did not; yet that difference might poſſibly proceed from the Tenacity, or ſome other diſpoſition of the matter, wherein the luminouſneſs of the Fiſh reſides: For I remembred that I had more than once obſerved a certain glimmering and ſmall Light to be produced in a ſort of Bodies upon putting them out of their former *Reſt*, and taking them into the Air, which ſparks would vaniſh themſelves ſometimes within one minute, ſometimes within a few minutes. But as theſe thoughts were but tranſient conjectures,ſo I ſhall not *entertain* you any longer about them,but *rather contenting* my *ſelf* with the hint *already given*,tak notice of what may be more certainly deduced from our Experiment,which is, That the *Air* may have a much greater *intereſt* in divers odd *Phænomena* of Nature,than we are hitherto aware of.

And for confirmation of our Experiment, I ſhall add, that having in another *Receiver* eclipſed a piece of Fiſh, that ſhone when 'twas put in more languidly than divers others that we had tried, I kept it about three days and three nights in a *Receiver*, which (*Receiver*) being ſomewhat like another, at firſt ſuggeſted to me, when I came to take it, ſome ſcruple, but afterwards, upon further examination, concluded it to be the ſame; wherefore I opened it in the dark, and upon letting in the Air on this Body, that ſhined but faintly at firſt, it immediately recovered its ſo long ſuppreſſed Light; and having included another piece that was yet more faint than this,when it was put into the *Receiver*, I thought fit to try at once the Experiment hitherto confirmed, and the *Converſe* of it. And therefore having kept this piece alſo three days and three nights in the *exhauſted Glaſs*, I let in the Air upon it, and notwithſtanding the darkneſs of the place,nothing of Life was thereupon revived.. But this being little other than I expected from a Body,that ſhined ſo faintly when 'twas put into the *Receiver*, and had been kept there ſo long, I reſolved to exerciſe my *patience* a while as well as my *curioſity*, and try, Whether the Appulſe and Contact of the Air would have that *operation* after *ſome time*, that it had not at *firſt*; and accordingly,after having waited a while,I obſerved the Fiſh to diſcloſe a Light, which though but dim, was manifeſt enough; but having conſidered it for ſome time, I had not leiſure to watch, whether 'twould increaſe, or how long 'twould continue.

I know not, *Sir*,whether you are weary with reading,but I am ſure I am quite tired with making ſo many Experiments upon *one*

Subject; and therefore I ſhall here conclude this Paper, as ſoon as I have added this Confirmation,as well of what I laſt related, as of ſomething that I obſerved before, That having included in ſmall *Receivers* two pieces of *rotten Whitings,* whereof the one, before it was put in, ſcarce ſhone ſo vividly, as did the other after the *Receiver* was exhauſted; and having ordered the matter ſo, that we were able to keep out the Air for ſome days, at the end of about 48 hours, we found, that the more ſtrongly ſhining Body retained yet a deal of Light; but afterwards looking upon them both in a dark place, we could not perceive in either any ſhow of Light. Wherefore having let in the Air into that *Receiver,* whereinto the Body that at firſt ſhined the faintlier had been put, there did not enſue any glimmering of Light for a pretty while: nay, upon the ruſhing in of the Air into the other Glaſs (then alſo made acceſſible to the *Atmoſphere)* the Body that at firſt ſhone ſo ſtrongly, and that continued to ſhine ſo long,ſhewed no glimmering of Light. But being reſolved to expect the iſſue a while longer, our patience was rewarded within leſs than a quarter of an hour with the ſight of a manifeſt light in the Body laſt nam'd, and a while after the other alſo became viſible, but by a Light very dim. The more luminous of theſe Bodies I obſerved to retain ſome Light 24 hours after; and the hitherto recited Experiment had this peculiar Circumſtance in it, That the two *Receivers* were uninterruptedly kept exhauſted no leſs than 4 days, and as many nights*.

* *What method the noble Author of theſe Experiments uſed in keeping out the Air for ſo long a time will probably be made known e're long by himſelf.*

An Account of two Books.

I. PARTHOLOGIÆ CEREBRI & NERVOSI GENERIS SPECIMEN: *In quo agitur de* MORBIS CONVULSIVIS & SCORBUTO, *ſtudio* THOMÆ WILLIS, *M.D.*

WHat this excellent Author formerly promiſed of the whole *Pathology* of *Brain* and *Nerves,* he gives in this Book a very conſiderable *Specimen* of. The knowledge of the Diſeaſes which uſe to affect theſe parts, is eſteemed very difficult and intricate, and particularly the true cauſes of *Convulſions* are of a very deep ſearch. For the clearing them up, this Author Philoſophiſeth